## Answer on question \#52486, Physics, Relativity

Question An unstable particle at rest breaks up into two fragments of unequal mass. The mass of the lighter fragment is equal to $2.50 \cdot 10^{-28} \mathrm{~kg}$ and that of the heavier fragment is $1.67 \cdot 10^{-27} \mathrm{~kg}$. If the lighter fragment has a speed of 0.893 c after the breakup, what is the speed of the heavier fragment?

Solution Relativistic momentum is

$$
p=\frac{m v}{\sqrt{1-\frac{v^{2}}{c^{2}}}}
$$

The momentums of fragments should be equal. Hence, momentum of heavier fragment $m_{2}$ is

$$
p=\frac{m_{1} 0.893 c}{\sqrt{1-0.893^{2}}} \approx 1.984 m_{1} c
$$

From this we can find velocity of heavier fragment $v_{2}$

$$
\begin{gathered}
p=\frac{m_{2} v_{2}}{\sqrt{1-\frac{v_{2}^{2}}{c^{2}}}} \\
p^{2}\left(1-\frac{v_{2}^{2}}{c^{2}}\right)=m_{2}^{2} v_{2}^{2} \\
v_{2}=\sqrt{\frac{v_{2}^{2}\left(m_{2}^{2}\right.}{\left(m_{2}+p^{2} / c^{2}\right)}}=\frac{1.984 m_{1} c}{\sqrt{m_{2}^{2}+1.984^{2} m_{1}^{2}}} \approx 0.285 c
\end{gathered}
$$

